

Abstract

We propose to perform a spectroscopic study of Λ hypernuclei beyond the p shell region with the best possible resolution, and to determine the spin-orbit potential of Λ hypernuclei in ${}^{28}_{\Lambda}\text{Al}$ and ${}^{51}_{\Lambda}\text{Ti}$. The approved experiment E89-09 which is under preparation intends to establish high resolution spectroscopy of Λ hypernuclei in the p shell region by the $(e,e'K^+)$ reaction. The present proposal is to extend the spectroscopy to the heavier targets such as ${}^{28}\text{Si}$ and ${}^{51}\text{V}$ with emphasis on revealing the spin-orbit interaction of a Λ hyperon in medium heavy nuclei.

Although experiments become difficult in the high Z region because of bremsstrahlung in the target, experiment E89-09 can be extended in a straightforward way up to the mass 50 region. By achieving sub-MeV energy resolution (around 600 keV), we will obtain quality hypernuclear spectra with the best energy resolution to date, and will reveal the structure of Λ hypernuclei beyond the p shell region. By using ${}^{28}\text{Si}$ and ${}^{51}\text{V}$ targets we will study the spectra of the ${}^{28}_{\Lambda}\text{Al}$ and the ${}^{51}_{\Lambda}\text{Ti}$ hypernuclei, respectively. The ls -splitting of Λ hyperon orbitals is expected to be greater in these heavier Λ hypernuclei, providing an opportunity to determine its magnitude. We propose to take advantage of the following unique characteristics of Jefferson Laboratory (JLAB):

- The $(e,e'K^+)$ reaction favorably excites both spin-flip and non-spin-flip high spin states.
- JLAB offers the best opportunity for the reaction spectroscopy of Λ hypernuclei with sub-MeV resolution.

We also intend to shed light on the current puzzling situation of the ΛN ls interaction and to investigate the structure of Λ hypernuclei beyond the p shell region in a qualitative way.